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ABSTRACT

For purposes of allied health education applicability, the perceptual domain was examined in terms of (1) its own taxonomy and (2) its relationship to taxonomies in the cognitive, affective, and psychomotor domains. All these taxonomies are hierarchical in style: perception involves extraction of information from presenting stimuli and there is progression of information extraction as the hierarchy is ascended. Perceptual performance at the high levels of the taxonomy assumes perceptual abilities at the lower levels. A diagrammed modified version of the taxonomy applicable to allied health education was developed which emphasizes all the senses singly and in combination. Students usually require repeated experience with a stimulus to develop diagnostic abilities and the perceptive component of diagnosis is an active process, one requiring individuals to explore the environment by interacting with it. Use of a separate taxonomy of educational objectives in the perceptual domain would assist health educators to plan instruction and to improve the relationship between classroom and clinical work. (The taxonomy is appended.) (CP)

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THE PERCEPTUAL DOMAIN

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ABSTRACT

A taxonomy of the perceptual domain was proposed over a decade ago. It is hierarchical in style, as are the taxonomies in the cognitive, affective, and psychomotor domains. Perception involves extraction of information from presenting stimuli and there is progression of information extraction as the hierarchy is ascended. Perceptual performance at the higher levels of the taxonomy assumes perceptual abilities at the lower levels. A modified version of the perceptual taxonomy applicable to allied health education is presented. Methods concerning application of the taxonomy are suggested. Use of the taxonomy of the perceptual domain would assist allied health educators plan instruction and evaluate teaching.

THE PERCEPTUAL DOMAIN

Introduction

Allied health educators have prepared instructional objectives for units of instruction for many years. They have applied the educational taxonomies of Bloom[1] for the cognitive domain, Krathwohl[2] for the affective domain, and Simpson[3], Harrow[4], or others for the psychomotor domain. The perceptual domain which classifies sensory dependent educational goals, has been used much less frequently even though Moore[5] proposed a hierarchy of perceptual behavior in 1967.

Two factors may account for the fact that educators in the allied health fields have neglected the perceptual domain. First, libraries in the allied health schools may not access the journals and books where materials related to the domain have been published. Second, perception is included in the other taxonomies. Simpson places perception at the first level of psychomotor performance whereas Harrow includes perceptual abilities at the third level in her taxonomy. Perception is either stated or implied in the cognitive domain. Bloom and Gronlund[6] provide examples of instructional objectives that require both sensory perception and discrimination. The interrelationship between the affective and perceptual domains also exists. In fact, the first level of the Krathwohl's affective domain is termed "receiving."

Attempts to develop instructional objectives for learning behaviors which are sensory dependent have been complicated by the overlap that occurs when perceptual behaviors are included within the cognitive, affective, and psychomotor domains. Much of the instructional content in the allied health fields is sensory dependent. Therefore, if perception is a component of cognitive, affective, and psychomotor learning,

and if these components can be organized and developed into a perceptual taxonomy, as was done by Moore, allied health educators should be able to utilize the taxonomy to plan instruction and evaluate student learning, especially laboratory and clinical instruction.

Principles Guiding Development of Educational Taxonomies

However, before adoption of the sensory dependent perceptual taxonomy is considered, it should be analyzed in terms of the principles that guided the taxonomists who developed the taxonomies in the cognitive, affective and psychomotor domains. The principles are listed here, although in an order different from that given in Bloom[7]. 1) The taxonomy should be logically developed with logical subdivisions. Furthermore, terms should be defined and used consistently. 2) Sublevels in the taxonomy should reflect teacher-distinctions among student behaviors. 3) The taxonomy should be compatible with current psychological principles and theories. 4) The classification scheme should be descriptive in nature in order to include every type of educational goal while at the same time remaining value free. In addition, the classification scheme should be hierarchical in nature with simpler behaviors included in more complex behaviors. Moore[8] stated that the proposed taxonomy was based upon two assumptions. First, that a number of diverse behaviors can be understood in terms of a single perceptual process and second, that "a hierarchy of information extraction is inherent in the nature of this process."

The perceptual taxonomy proposed by Moore does appear to follow these principles. Moore applied the perceptual taxonomy to musical performance[9] and auto mechanics[10] to demonstrate that perceptual tasks

could be developed logically and hierarchically arranged. Each level required increased information extraction from presenting stimuli and higher levels in the hierarchy subsumed perceptual tasks at the lower levels. She defined and used terms consistently. The taxonomy reflected distinctions teachers made concerning student behaviors. Furthermore, it was based on principles and theories of perception and learning in a manner capable of classifying all types of perceptual behavior. The taxonomy is neutral because it does not convey value judgements.

Background

Moore conceived the taxonomy of perceptual behavior as she developed aptitude tests to help select students for admission to courses in music and automotive mechanics. While these two areas of instruction are quite different as far as content is concerned, both rely on the ability of students to make auditory discriminations if learning is to be successful. The need for perceptual skills in music is fairly obvious. It may be less obvious to those of us who are unfamiliar with auto mechanics that auditory perception is related to diagnosis of malfunctions in automobile engines, chassis, and transmissions.

The Perceptual Process Distinguished From Perception

Moore distinguished between the perceptual process and perception. She stated that the perceptual process was analogous to the process of respiration, a physiological process. Inspiration and expiration are the phases of respiration. Sensory input and output (behavior) are the phases of the perceptual process. The sensory input

phase refers to perception whereas the output phase refers to voluntary human motion. Moore defined the perceptual-motor domain as all forms of voluntary human motion: the output phase of perceptual motor actions.

In contrast, the same term has frequenlty been used to refer to the perceptual process as well as to perception. For example, Davis et al define a perceputal motor skill as a single entity "... a coordinated series of muscular movements to successfully complete a task." However, perception may exist apart from motor behavior. Not all perceived sensory stimuli trigger psychomotor activity. Stimuli may be perceived and ignored. Furthermore, perception may result in cognitive or affective behavior rather than psychomotor behavior.

Moore defined the perceptual domain as all forms and products of behavior concretely related to information extraction: the sensory or input phase of perceptual-motor action. Moore uses the term perception, then, only to identify the input phase or the act of extracting invarient aspects of information from sensory stimuli.

Dimensions of Perception

Perception has five dimensions. First, perception is an active process requiring individuals to react to stimuli and link stimuli (input) with behavior (output). We determine which stimuli we will respond to, thereby adapting to the environment, including responses and actions of others. Second, we extract information from internal stimuli such as proprioceptive or kinesthetic stimuli. Third, responses may themselves convey stimulus information or become reafferent by a feedback mechanism. Fourth, perceptual abilities are developmental in nature. Sensory

improverishment early in life may result in a lack of curiosity, inability to focus attention, as well as the inability to distinguish relevant from irrelevant stimuli. Finally, previous experiences may modify perception. All of the dimensions which characterize perception, with the possible exception of the developmental dimension, are important to the diagnostic process.

The Perceptual Process

Moore described the diagnostician as a communication channel because the perceptual process consists of input, data processing, and output phases. The stimulus provides the input. Perception begins when the diagnostician extracts information from the presenting stimulus. The data processing consists of the neural and mental activies that relate input and output. The diagnostic response constitutes the output phase. The perceptual process is diagramed in Figure 1.

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Figure 1 goes in here

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The arrows directed toward the right in the Figure depict the direction of flow from the stimulus energy (informational aspects of the stimuli) whereas the arrows directed toward the left depict internal (reafferent) feedback. The broken lines represent loss of energy which occurs during internal feedback. This feedback is essential if perceptual learning is to occur because most perceptual learning takes place through a series of successive approximations. Students usually require repeated experiences with a stimulus or series of stimuli in order to develop their diagnositc abilities. The ability to distinguish

subtle differences in the pulse beat of a critically ill patient, for example, is learned through guided practice. That is not to say that a single event may not result in learning, it may. As an example, a single whiff of paraldehyde may imprint the memory of this odor in an individual's brain for life.

The Perceptual Domain

The taxonomy of the perceptual domain includes objectives concerned with sensory-dependent activity performed by learners in response to stimuli. The first two levels, sensation and figure perception, are almost reflex in nature. The last three levels, symbol perception, perception of meaning and perceptive performance, are modified by experience and are partly cognitive in nature and reflect both individual and cultural differences. Moore dealt primarily with visual, auditory and tactile perceptions, only once referring to taste or odor. A version of the taxonomy proposed by Moore in 1970 and modified by the author,[12,13] is given in Table 1. The following modifications were made. Olfactory, gustatory, and kinesthetic senses have been added. Behavioral terminology was employed. In some instances subcategories have been expanded while in other instances they have been collapsed for purposes of clarification. Examples have been provided to relate the taxonomy to allied health fields. Readers are encouraged to refer to Moore's taxonomy either in the references already cited or in Redman.[14]

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Table 1 goes in here

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Relationships Between the Domains of Learning

Relationships exist between the different domains. In the teaching-learning process, students must first perceive the stimulus (perceptual domain). Second, they must be willing to respond to the stimulus and willing to perform according to specific standards (affective domain). Third, students must know how to respond (cognitive domain). Finally, students must have the required skills (psychomotor domain and cognitive domain). Only after the perceptual, affective, and cognitive components have been triggered are students ready to perform the task. While psychomotor components are the last called forth, psychomotor performance involves elements of all domains if successful performance of the task is to occur.

Application of the Perceptual Domain to Allied Helath Education

The perceptual domain can be applied in many ways to allied health education. The diagnostic procedures employed in patient assessment, determining how to implement specified treatment, evaluating whether or not treatment is effective, and performing laboratory tests are only a few examples of procedures that rely heavily on perceptual abilities of students, instructors, and practitioners. In addition, although the allied health fields may use electronic and mechanical equipment to diagnose and treat as well as monitor the condition of patients, interpreting data or trouble shooting problems with the equipment are sensory dependent activities.

Instructors will have to consider the perceptual level at which students are prepared to function and plan learning experiences accordingly. Consider, for example, the perceptual abilities requried to

assess a comatose patient. What diagnostic skills (perceptions) will students need to learn or perfect? Some perceptual observations might include:

Take vital signs

pulse - determine rate, rhythm, regularity, quality, etc.

respirations - determine rate, depth, regularity, patterns (such as Cheyne-Stokes or Kussmaul), apnea, if labored, etc.

blood pressure - check systolic and diastolic rates, quality, etc.

temperature - check using a thermometer

Check skin for color, temperature (determine tactily), moistness, turgor, pressure areas, cuts or abrasions, signs of infection, etc.

Note odor of breath, body odor, odor of discharge from wounds, body orifies, etc.

Palpate the abdomen to check for distention

Check occular tension by digital pressure

Observe limbs for movement, flaccidity or spasticity, fractures, etc.

Check for incontinence

Although this list is not complete, it can be used to stress certain points. First, virtually all the senses are employed singly or in combination. Visual perception is involved in determining the patient's level of consciousness, checking the pupils, respirations, skin, and so forth. Auditory perception is required to take the blood pressure and check respirations among other skills. Tactile perceptual skills are

utilized to dermine body temperature while olfactory perception is required to identify breath odor, etc. Kinesthetc perception is required to take the pulse, check for deep tendon reflexes, determine skin turgor, palpate the abdomen, etc.

Second, combinations of senses are required in order to make certain diagnostic tests. Henak[15] noted that experienced furniture finishers were impeded in efforts to determine the smoothness of sanded surfaces if they were not able to inspect the surfaces visually (at different angles and under different lighting conditions) as well as to test the surfaces tactily. Practitioners in the allied heath agencies are similarly impeded in making diagnostic determinations when they are not abie to use their combined senses. For example, in checking for skin turgor, some information may be extracted by kinesthetic perceptions, taking the skin between thumb and index finger and noting the elasticity. However, more information can be obtained if the skin is observed while this is done. How firm is the tissue? How rapidly does the skin return to its former condtion after it is released? Did the skin wrinkle? Did any changes in color occur during the manipulation of the skin fold? Each additional piece of information refines the diagnosis.

Third, it is essential for instructors to be actively involved with students when they are in the clinical facilities to teach and monitor their performance. In order for students to learn and improve their diagnostic performance, they are required to make comparative judgements. This involves judging the quality of an unknown stimulus against the quality of a standard stimulus. Instructors must be with students to assist them learn the standards (vital signs, microscopic

examinations, range of motion exercises, etc.) and then determine when conditions are the same as, greather than or below these standards.

Knowledge of the results can increase the level of performance. Therefore, students require feedback from instructors concerning their perceptual determinations. They improve by making successive approximations. Instructors must be present to monitor students' diagnostic performance. The significance of diagnostic performance is also learned.

Fourth, educators in the allied health fields need to develop instructional objectives in the perceptual domain for courses they teach. Perceptual skills need to be considered separately. While it is true that there are relationships between the domains of learning, it is essential to focus on each domain when planning learning experiences for students. Cognitive skills are important but cognition is a passive process that involves little interaction with the environment. Perception on the other hand is an active process and requires individuals to explore the environment by interacting with it. Perception validates cognition. Once perceptual skills have been identified, it should be possible to improve the relationship between classroom and clinical instruction.

Evaluation of instruction often employs inadequate measurement criteria because analysis of what students should be able to do as a result of instruction has been inappropriately or inprecisely stated. Often paper and pencil tests have been used to measure instructional objectives related to the senses. If tests are to represent the ultimate criteria of student learning, the dimensions of the criteria must be analyzed and tested accordingly.

Fifth, allied health educators themselves need to practice their perceptual skils by regularly assuming the practitioner role. Perceptual abilties diminish if they are not maintained through practce. It is reported that cardiac surgery teams must operate at least ten times a week otherwise team performance slips while rates for postoperative complications and deaths rise.

Finally, if allied health educators employ the perceptual domain to specify objectives of instruction, it might be possible to reduce legal problems which ensue when candidates are refused admission to allied health programs because of sensory impairments. Objectives of instruction that specify students must be able to make certain auditory, visual, tactile or other perceptual discriminations should reduce claims of capriciousness or discrimination by candidates denied admission. Well specified perceptual objectives of instruction would also help prevent schools of allied health becoming involved in situations similar to that experienced recently by a respiratory therapy program in an Illinois community college, which was forced to accept a blind student because prerequisites did not specify that candidates had to be sighted to be eligible for admission to the program.

Summary

Background information dealing with the development of a taxonomy of the perceptual domain was given. Perceptual performance may occur without being linked to psychomotor performance and perceptual performance may result in cognitive or affective behavior rather than psychomotor behavior, therefore, a separate taxonomy of educational objectives in the perceptual domain will assist allied health educators

develop instructional objectives and plan student learning experiences. The distinction between perceptual process and perception was made. A version of Moore's taxonomy of the perceptual domain modified by the author was presented. Benefits of adopting the taxonomy by allied health educators were considered.

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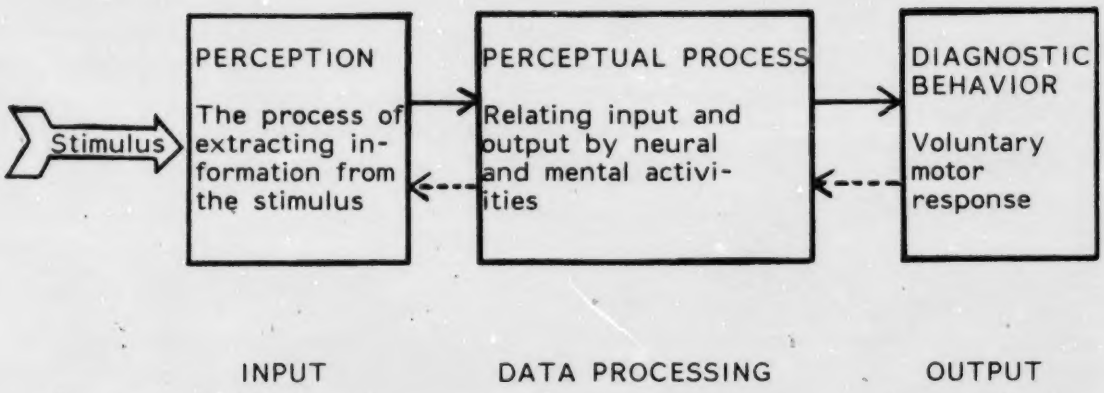

Figure 1. Diagramatic representation of the perceptual process.

TABLE 1

A PROPOSED MODIFIED VERSION OF THE PERCEPTUAL TAXONOMY FOR DEVELOPING INSTRUCTIONAL OBJECTIVES CONCERNED WITH SENSORY-DEPENDENT ACTIVTIY PERFORMED BY STUDENTS IN ALLIED HEALTH FIELDS IN RESPONSE TO STIMULI

1.00 SENSATION

Demonstrate awareness of informational aspects of stimuli including detection and awareness of change. Employ all sensory modes to measure changes in threshold stimuli.

1.10 IDENTIFY SENSORY ATTRIBUTES.

1.11 Identify colors.

1.12 Identify sounds. Ex. Identify patterns of respiration.

1.13 Make tactile discriminations. Ex. Determine if pre-operative area was shaved satisfactorily.

1.14 Detect odors. Ex. Identify acetone odor on a patient's breath.

1.15 Identify tastes. Ex. Determine whether a sample of food has been salted.

1.16 Make proprioceptive discriminations. Ex. Determine when the needle has penetrated a vein wall while starting I.V. solutions.

1.20 SPECIFY THE ATTRIBUTE THAT HAS CHANGED.

1.21 Describe change in the color of litmus paper. (visual)

1.22 Record changes in blood pressure. (auditory)

TABLE 1 (continued)

1.23 Identify temperature changes of inflamed joints by touch.

1.24 Determine changes in odor of a purulent discharge. (olfactory)

1.25 Determine change in flavor of a sample of milk. (gustatory)

1.26 Determine change in suppleness of leather in a prosthetic limb. (proprioceptive)

1.30 SPECIFY THE DIRECTION OF CHANGE.

1.31 Decide when a child's crutches have become too short. (visual)

1.32 Note decrease in the pitch of sound as steam escapes from an autoclave. (auditory)

1.33 Detect dulling of a needly by tactile means.

1.34 Determine increase in odor of a purulent discharge. (olfactory)

1.35 Detect souring of milk. (gustatory)

1.36 Determine if a patient's range of motion has increased during passive range of motion exercises. (proprioceptive)

1.40 SPECIFY THE DEGREE OF CHANGE

In most instances this would involve the use of instruments or measuring devices such as scales, thermometers, color charts, calipers, guages, etc. in order to specify the degree of change. Sometimes degrees of change can be estimated.

TABLE 1 (continued)

1.41 Determine when a lesion has doubled in size. (visual)

1.42 Specify the degree of change in a sound. (auditory)

1.43 Determine when a tumor has doubled in size. (proprioceptive)

2.00 FIGURE PERCEPTION

Demonstrate awareness of entity including discrimination of unity, sensory-perceptual organization, and resolution of detail.

2.10 DISCRIMINATE UNITY.

Employ all sensory modes to discriminate changes in unity of a threshold stimulus.

2.11 Judge brightness as a property of the stimulus under varying illumination. Ex Examine slide under different illuminations to identify organisms. (visual)

2.12 Judge distance from source of origin of light/sound. Ex. Estimate the location of an ambulance by the sound of the siren.

2.13 Judge tactile qualities such as hot or cold; sharp or dull; smooth or rough; moist or dry; etc.

2.14 Judge olfactory qualities such as minimal or strong; irritating or pleasant; putrid or fresh; etc.

2.15 Judge gustatory qualities such as sweet or sour; salty or nonsalty; seasoned or bland; etc.

TABLE 1 (continued)

2.16 Judge kinesthetic (proprioceptive) qualities such as heavy or light; hard or soft, stretched or relaxed; plastic or unyielding; tough or soft, free or fixed (e.g. a lump or tumor); etc.

2.20 PERCEIVE FIGURE-GROUND ORGANIZATION.

2.21 Relate parts to each other and to the whole. Ex. Describe abnormalities observed on a chest x-ray.

2.21 Disriminate between parts and the background, matrix, or context. Ex. Read a TB skin test.

2.30 RESOLVE DETAIL.

Respond to sensory detail. Judge size, shape, volume, weight, etc. as properties of stimuli.

2.31 Judge size as a property of the stimulus at various distances.

2.32 Judge shapes as a property of the stimulus regardless of the oreintation.

2.33 Test field-dependence.

2.34 Test spatial orientation.

2.35 Judge volume of a property.

2.36 Judge weight of an indiviual, mass, etc.

2.40 RESPOND TO DETAIL IN THE SENSORY FIELD.

2.41 Discriminate symetrical figures from asymetrical figures.

TABLE 1 (continued)

2.42 Perceive rapidly successive pieces of information.
Ex. Perceive changes on an ekg or eeg printout.

2.43 Distinguish between cries of infants.

3.00 SYMBOL PERCEPTION

Demonstrate awareness of figures in the form of denotative signs when associated meanings are not considered.

3.10 IDENTIFY FORM OR PATTERN.

Identify form or pattern and relation of discrete information into sensory forms; recognize thresholds in all sensory modalities.

3.11 Distinguish curved lines from straight lines.

3.12 Distinguish rectangles from triangles from circles, etc.

3.13 Identify letters/digits.

3.14 Respond to gross facial expressions/body movements appropriately.

3.15 Distinguish heart sounds using a stethescope.

3.16 Abstract an electrocardiogram pattern from its variations.

3.17 Distinugish color components of a visual spectrum/composition. Ex. Clinitest, Acetest, Testape, etc.

3.18 Respond to written directions appropriately.

3.20 NAME/CLASSIFY FORMS OR PATTERNS.

3.21 Recognize persons. Identify people by name.

3.22 Identify simplifications/schematic drawings.

TABLE 1 (continued)

3.23 Name complex objects, pictures, places, sounds, tastes, odors, etc.

3.24 Comprehend physical activity or meaning denoted by written nouns or verbs, literal meanings such as "food" or "feed" (see 4.23).

3.25 Classify sensory forms or their representations (visual, auditory, tactile, olfactory, gustatory, propriocpetive) according to their similarities and differences.

4.00 PERCEPTION OF MEANING

Interpret significance or assign personal significance to commonly encountered forms, patterns, or events.

4.10 MANIPULATE MENTALLY THE IDENTIFIED FORM OR PATTERN.

4.11 Reproduce forms, sounds, or syllables from memory.

4.12 Overcome constancies of brightness, color, size, or shape.

4.20 ATTACH SIGNIFICANCE TO SYMBOLS.

Relate symbols in order to achieve significant synthesis.

4.21 Understand various parts of speech. Comprehend language.

4.22 Make simple associations in all sensory modalities; e.g. 4+ Clinitest signifies sugar in the urine.

4.23 Understand verbal imagry, similies, metaphors, analogies, and other figures of speech. Connotative meanings such as "food for thought" or to "feed one's ego" (see 3.24).

TABLE 1 (continued)

4.30 ATTACH SIGNIFICANCE TO A SERIES OF EVENTS OCCURING OVER A PERIOD OF TIME.

4.31 Demonstrate insight into cause-effect relationships.

4.32 Discover new relationships between events.

4.33 Make generalizations concerning a series of events.

a. Understand implications of events.

b. Make decisions based on occurrences of events

5.00 PERCEPTIVE PERFORMANCE

Make sensitive/accurate observations. Make complex decisions where many factors are involved. Change ongoing behavior in response to observations.

5.10 PROBLEM SOLVING.

Demonstrate success in applying analytical or global approach to problem solving in all areas of endeavor.

5.11 Analyze effects of action taken.

5.12 Modify actions to respond to changes in conditions.

5.20 DIAGNOSTIC DECISIONS.

Make diagnostic decisions concerning mechanical/electrical systems, medical problems, etc.

5.21 Plan an exercise program for a client to respond to his/her condition and changes in condition.

5.22 Determine when to administer medications ordered p.r.n.

5.30 INSIGHTFUL DECISIONS.

Demonstrate insight in political, social, or personal situations.

TABLE 1 (continued)

5.31 Aware of own needs, attitudes, desires, moods, intentions, perceptions, thoughts, etc.

5.32 Perceive needs, attitudes, desires, moods, intentions, perceptions, thoughts of others.

5.40 CREATIVITY.

Demonstrate artistry/creativity in any medium.

5.41 Deal creatively in interpersonal relationships such as: student - teacher; client - practitioner; peer relationships; collegial relationships.

5.42 Create a prosthetic device for a client by taking measurements, designing the prosthesis, constructing, and fitting it.